REMARKS

Claims 1, 2 and 4-7 are pending in the present application. Claims 1, 2 and 4-7 are rejected. Claim 2 is herein canceled.

Claim Objections

Claim 2 is objected to as being of improper dependent form for failing to further limit the subject matter of a previous claim. Since the silicon carbide has a Mohs hardness of 9, the scope of claim 2 is broader than claim 1 since the Mohs hardness of silicon carbide is inherently "6 or more".

Applicants herein cancel claim 2, thus mooting the rejection.

Claim Rejections - 35 U.S.C. §103

Claims 1, 2, and 4-7 are rejected under 35 U.S.C. §103(a) as being unpatentable over Brewer (US 5,856,278) in view of Hiles (US 4,049,396).

The Examiner asserts that Brewer discloses in examples 1 and 2 in column 2 where solvated NBR (unvulcanized rubber of the binder) is present in an amount of 15 vol. %.

The Examiner admits that Brewer fails to disclose abrasive particles other than alumina or rubber other than NBR. In view of the asserted recognition of Hiles' that aluminum oxide and silicon carbide are equivalent and interchangeable in friction or abrasive compositions, the Examiner concludes that it would have been obvious to substitute silicon carbide with aluminum oxide and thereby arrive at the presently claimed invention.

With respect to other types of rubber (i.e., claim 4), the Examiner asserts that while Brewer exemplifies NBR and nitrile rubbers, the reference is open to other suitable conventional rubbers (column 3, lines 13-14), including those presently claimed. Therefore, the Examiner concludes that it would have been obvious to utilize other conventional rubbers with an expectation of comparable results, absent evidence to the contrary, and thereby arrive at present claim 4.

Applicants respectfully disagree with the rejection because not all of the claimed limitations are met by the cited references. Specifically, the limitation of the quantity of 1-10% of abrasive silicon carbide particles is not met by the cited references.

Applicants note that Brewer discloses in column 1, lines 37-40, an inclusion of "5-80% by volume of a finely divided abrasive", which amount initially appears to read on the presently claimed 1-10% of abrasive.

However, Applicants submit that the reference does not properly teach the cited range because above statement is a typographical error that would have been recognized as plain on its face by one skilled in the art. While the text indeed includes the "5-80%" recitation, a review of the remainder of the disclosure of Brewer indicates that column 1, lines 37-40 should obviously read "15-80%", rather than "5-80%". Applicants note that Examples 1-3 of Brewer indicate abrasive content of 15%, 40%, and 20%, respectively. Further, independent claims 1 and 7 recite a minimum content of 15% of abrasive.

Because one skilled in the art would, upon reading Brewer, immediately realize that the 5% as recited in its column 1 is a typographical error, Applicants assert that one skilled in the art

would not have been motivated to include less than the minimum 15% abrasive as taught by Brewer, and would therefore not have reached the present invention.

With respect to the NBR used as an organic binder in Brewer, Applicants note that the NBR as a starting material of the friction material of Brewer is unvulcanized (non-crosslinked), like the unvulcanized rubber in the present invention, but the NBR of Brewer contains some crosslinking agent so that the NBR contained in the friction material as the final product is in a vulcanized (crosslinked) form. This is because the NBR (solvated) is explained in Brewer as an organic binder. A vulcanized rubber is chemically stable and does not work sufficiently as an organic binder. In other words, the binding function of the vulcanized rubber is imparted by the vulcanization.

On the other hand, as apparent from the fact that the unvulcanized rubber in the present invention is classified as filler, the unvulcanized rubber contains no crosslinking agent and, therefore, is used as filler with no function as an organic binder.

Secondly, with respect to the interchangeability of aluminum oxide and silicon carbide, Applicants note that claim 8 of Hiles reads as follows:

> "...the abrasive particles are selected from aluminum oxide, asbestos, boron carbide, a calcite, silicon carbide, glass, molybdenum disulphide, a metal silicate, silicon carbide, tungsten carbide, a powdered or granulated carbon, carbon fibers, marble, quartz, and tungsten dioxide."

The description seemingly shows that aluminum oxide and silicon carbide are equivalent and interchangeable. However, it should be noted that in column 1 lines 18 to 24 of Brewer, there is a description reading:

> "More recently it has been proposed to use aluminum alloys as brake rotor material. In particular, aluminum alloy containing silicon carbide particles has been proposed. Such alloys are very different in behavior to cast iron, because they are extremely hard. Although they may appear superficially quite smooth, they are also very abrasive due to the presence of substantial amounts of silicon carbide."

This description clearly shows that when an aluminum alloy containing silicon carbide is used as a material of a brake rotor, the brake rotor has high abrasive property.

For this reason, for sufficient resistance to this abrasive property, when silicon carbide is used as a material of a brake rotor, it is preferred that the abrasive particles used as a component of the friction material preferably has a hardness which is the same as or higher than that of silicon carbide. In fact, paragraph [0042] of the publication of the present application contains the following description:

> "The abrasive particles preferably have a Mohs hardness of 6 or more, particularly preferably 8 or more, because hard, inorganic particle materials for reinforcing a rotor, drum or the like of aluminum alloy generally have a Mohs hardness of 6 or more, and the abrasive particles as the friction material component are preferably harder than the corresponding aluminum alloy."

As apparent from the above, the hardness is an important factor of the abrasive particles, and this is the reason for the limitation of the material of the abrasive particles in claim 1 to silicon carbide.

From the above, it would have been clear to one skilled in the art at the time of the invention that aluminum oxide and silicon carbide are not equivalent, because of the difference between these compounds in the hardness other than the Mohs hardness. For example, the Vickers hardness (Hv) of aluminum oxide is approximately 12 to 16 GPa, whereas the Hv of silicon carbide is approximately 22 to 25 GPa.

Moreover, it should be noted that in the above-mentioned description in Claim 8 of Hiles, aluminum oxide, silicon carbide and asbestos are regarded as equivalent. However, one would not have regarded them equivalent, because the hardness of asbestos is lower than that of aluminum oxide and silicon carbide (in addition to the fact that the present invention is directed to a non-asbestos-based friction material). This suggests that the criterion of the equivalence of the compounds as friction material in Hiles is not based on the actual hardness thereof.

As apparent from the above, aluminum oxide and silicon carbide are not equivalent in view of their hardness, and it would not have been obvious for a person skilled in the art to substitute the alumina in Brewer with silicon carbide.

In view of the aforementioned amendments and accompanying remarks, Applicants submit that that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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